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TITLE: Heat shrinkable films containing single site catalyzed copolymers having long chain branching

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INVENTOR-INFORMATION:

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CLAIMS:

I claim:

1. A heat shrinkable multilayer film comprising at least one inner core layer comprising a homogeneous single site catalyzed copolymer of ethylene and an alpha-olefin having from four to ten carbon atoms and having at least some long chain branching said copolymer having a density of from about 0.89 g/cc to about 0.91 g/cc.
2. The heat shrinkable film of claim 1 wherein said alpha-olefin having from four to ten carbon atoms is octene.
3. The heat shrinkable film of claim 1 wherein said homogeneous branched copolymer is blended with another thermoplastic homopolymer or copolymer.
4. The heat shrinkable film of claim 3 wherein said other thermoplastic homopolymer or copolymer is a copolymer of ethylene and a second comonomer selected from the group consisting of vinyl acetate, alkyl acrylate, carbon monoxide, butadiene, styrene, acrylic acid, methacrylic acid, a metal neutralized salt of an acrylic acid, and an alpha-olefin.
5. A heat shrinkable multilayer film comprising at least two core layers, each of said core layers comprising a homogeneous single site catalyzed copolymer of ethylene and an alpha-olefin having from four to ten carbon atoms and having at least some long chain branching said copolymer having a density of from about 0.89 to about 0.91.
6. The heat shrinkable film set forth in claim 5 wherein the homogeneous branched copolymer of one of said two core layers is identical to the homogeneous branched copolymer of the other of said layers.
7. The heat shrinkable film set forth in claim 5 wherein the alpha-olefin having from four to ten carbon atoms is octene.
8. The heat shrinkable film of claim 5 wherein said homogeneous branched copolymer is blended with another thermoplastic homopolymer or copolymer.
9. The heat shrinkable film of claim 5 wherein said other thermoplastic homopolymer or copolymer is a copolymer of ethylene and a second comonomer selected from the group consisting of vinyl acetate, alkyl acrylate, carbon monoxide, butadiene, styrene, acrylic acid, methacrylic acid, a metal neutralized salt of an acrylic acid, and an alpha-olefin.
10. The heat shrinkable film of claim 5 wherein the homogeneous branched copolymer has a density of from about 0.90 g/cc to about 0.91 g/cc.
11. A heat shrinkable multilayer film comprising the general structure:
seal/core/barrier/core/abuse
wherein each of the core layers comprises the same homogeneous long chain branched single-site catalyzed copolymer of ethylene and an alpha-olefin having from four to ten carbon atoms, said copolymer having a density of from about 0.89 g/cc to

about 0.91 g/cc.

12. The heat shrinkable film of claim 11 wherein said alpha-olefin having from four to ten carbon atoms is octene.

13. The heat shrinkable film of claim 11 wherein said homogeneous branched copolymer is blended with another thermoplastic homopolymer or copolymer.

14. The heat shrinkable film of claim 13 wherein said other thermoplastic homopolymer or copolymer is a copolymer of ethylene and a second comonomer selected from the group consisting of vinyl acetate, alkyl acrylate, carbon monoxide, butadiene, styrene, acrylic acid, methacrylic acid, a metal neutralized salt of an acrylic acid, and an alpha-olefin.

15. The heat shrinkable film of claim 11 wherein the homogeneous branched copolymer has a density of from about 0.90 g/cc to about 0.91 g/cc.

16. The heat shrinkable film of claim 11 wherein the barrier layer comprises a vinylidene chloride copolymer.

17. The heat shrinkable film of claim 16 wherein the barrier layer comprises a vinylidene chloride-methyl acrylate copolymer.

18. The heat shrinkable film of claim 11 wherein the seal layer comprises a copolymer of ethylene and a comonomer selected from the group consisting of vinyl acetate, alkyl acrylate, acrylic acid, methacrylic acid, a metal neutralized salt of an acrylic acid, and an alpha olefin.

19. The heat shrinkable film set forth in claim 11 further including additional internal layers to promote interlayer adhesion.

20. A heat shrinkable multilayer film comprising:

a) a seal layer;

b) a first core layer comprising a homogeneous, long chain branched ethylene alpha-olefin copolymer having a density of from about 0.89 g/cc to about 0.91 g/cc;

c) a barrier layer;

d) a second core layer comprising a homogeneous, long chain branched ethylene alpha-olefin copolymer having a density of from about 0.891 g/cc to about 0.91 g/cc; and

e) an abuse layer;

wherein the homogeneous, branched ethylene alpha-olefin of the first core layer differs from that of the second core layer.

21. The heat shrinkable film claim 20 further including additional internal layers to promote interlayer adhesion.

22. A multilayer heat shrinkable film comprising:

a) a sealing layer comprising a homogeneous, single site catalyzed copolymer of ethylene and a alpha-olefin with four to ten carbon atoms, said copolymer having long chain branching and a density of from about 0.89 g/cc to about 0.91 g/cc;

b) a barrier layer; and

c) an abuse layer comprising a homogeneous single site catalyzed copolymer of ethylene and a alpha-olefin with four to ten carbon atoms, said copolymer having long chain branching and a density of from about 0.89 g/cc to about 0.91 g/cc.

23. A heat shrinkable multi-layer film comprising the general structure:

seal/core/barrier/core/abuse

wherein each of the two core layers comprises the same homogeneous copolymer of ethylene and octene having an $I_{sub.10} / I_{sub.2}$ greater than or equal to 5.63 and a M_w/M_n , less than or equal to $(I_{sub.10} / I_{sub.2}) - 4.63$, said copolymer having a density of from about 0.89 g/cc to about 0.91 g/cc.

24. The heat shrinkable film of claim 23 wherein at least one of said core layers further includes another thermoplastic homopolymer or copolymer blended with the homogenous ethylene octene polymer.

25. The heat shrinkable film of claim 24 wherein said other thermoplastic homopolymer or copolymer is a copolymer of ethylene and a second comonomer selected from the group consisting of vinyl acetate, alkyl acrylate, carbon monoxide, butadiene, styrene, acrylic acid, methylacrylic acid, a metal neutralized salt of an acrylic acid and an alpha olefin.

26. The heat shrinkable film of claim 25 further including additional internal layers to promote interlayer adhesion.

27. A heat shrinkable multilayer film as set forth in claim 26 wherein the homogenous ethylene octene copolymer of said first core layer differs from that of said second core layer.

28. The heat shrinkable multilayer film comprising:

a) a sealing layer;

b) a first core layer comprising a homogeneous ethylene octene copolymer having an $I_{sub.10} / I_{sub.2}$ greater than or equal to 5.63 and an M_w/M_n less than or equal to $(I_{sub.10} / I_{sub.2}) - 4.63$ and having a density of from about 0.89 g/cc to about 0.91 g/cc;

c) a barrier layer;
d) a second core layer comprising a homogenous ethylene octene copolymer having an $I_{sub.10} / I_{sub.2}$ greater than or equal to 5.63 and an M_w/M_n less than or equal to $(I_{sub.10} / I_{sub.2}) - 4.63$ and having a density of from about 0.89 g/cc to about 0.91 g/cc;

e) an abuse layer.

29. The heat shrinkable film set forth in claim 28 further including additional internal layers to promote interlayer adhesion.

30. The heat shrinkable film set forth in claim 28 wherein the homogenous ethylene octene copolymer of at least one of said first and second core layers is blended with another thermoplastic homopolymer or copolymer.

31. The heat shrinkable film set forth in claim 30 wherein said other thermoplastic homopolymer or copolymer is a copolymer of ethylene and a second comonomer selected from the group consisting of vinyl acetate, alkyl acrylate, carbon monoxide, butadiene, styrene, acrylic acid, methacrylic acid, a metal neutralized salt of an acrylic acid and an alpha olefin.

32. A heat shrinkable multi-layer film comprising the general structure:
seal/core/abuse

wherein the core layer comprises a homogeneous long chain branched single site catalyzed copolymer of ethylene and an alpha-olefin having from four to ten carbon atoms, said copolymer having a density of from about 0.89 g/cc to about 0.91 g/cc.

33. The heat shrinkable film of claim 32 further including a second core layer, said core layer comprising a homogeneous long chain branched single site catalyzed copolymer of ethylene and an alpha-olefin having from four to ten carbon atoms, said copolymer having a density of from about 0.89 g/cc to about 0.91 g/cc.